Contents

Innovation Insight 2

Innovation Insight 3

Innovation Insight 4

Innovation Insight 5

Innovation Insight 6

Innovation Insight 7

Innovation Insight 8

Innovation Insight 9

Innovation Insight 10

Innovation Insight 11

Innovation Insight 12

Introduction

Leadership is about paying attention to ideas and trends in the periphery as well as organizing for the unforeseen and rehearsing potential responses to future scenarios. Data, of course, can help, but so too can experience and an openness to be continually "trying, learning, and adapting." In this selection of articles from *MIT Sloan Management Review*, we look at how leaders can develop thoughtful strategies for thinking through complex problems.

From "Five Rules for Managing Large, Complex Projects":

- "Megaprojects" — defined as projects with budgets exceeding $1 billion — have proved notoriously difficult to deliver on time and

on budget; one estimate suggests that 90% of them end up over budget.

- Complexity usually increases with project scale, and complexity can give rise to uncertainty and an inability to foresee the difficulties, changing conditions, and unanticipated opportunities that will be encountered once the project is underway.

- One way to manage the uncertainties is to follow five simple rules that encourage innovation to deal with uncertainty and confer the flexibility to change — while maintaining the stability required to deliver projects efficiently.

- These suggestions are applicable to all large-scale, long-term projects, not just projects with billon-dollar budgets.

From "Moving Beyond the Silicon Valley State of Mind":

- Christian Madsbjerg's book *Sensemaking: The Power of the Humanities in the Age of the Algorithm* is a polemic defending the need for the liberal arts in business.

- Relying on data alone is taking "a journey determined by the reductions of a GPS," writes Madsbjerg. Sensemaking, on the other hand, is like following the North Star: It provides the essential context for data — the rationale for collecting it and the perspective needed to gain insight from it.

- In an excerpt from the book, Madsbjerg illustrates the difference between traveling by the North Star and traveling via GPS by comparing the approach that Napa Valley winemaker Cathy Corison takes to her craft with that of Leo McCloskey, founder of Sonoma, California-based Enologix Inc., a consultancy that applies predictive analytics to wine making.

- In Madsbjerg's words, Enologix, promotes "a 'Moneyball' approach to wine making, an audacious move in a culture that holds firmly to its identity as an artisanal craft." In contrast, "when you

drink Cathy Corison's wine," he writes, "you are experiencing everything she cares about: a profundity of data that can never be captured in an algorithm."

From "12 Essential Innovation Insights":

- For decades, *MIT Sloan Management Review* has published research and insights about innovation. For this article, we tapped into that knowledge base, looked for older articles that still retain wide relevance, and distilled 12 key innovation insights.

- For example, Innovation Insight 1: Innovation isn't necessarily about new things; it's about new value. In a 2006 MIT SMR article titled "The 12 Different Ways for Companies to Innovate," the authors note that viewing innovation too narrowly "blinds companies to opportunities." Starbucks, for instance, initially innovated not by producing a different product but instead by creating a different kind of customer experience — offering what the company called a "third place" for gathering that was between home and work.

- Innovation Insight 4: Remember that being first to market is no guarantee of success. A 1996 article "First to Market, First to Fail? Real Causes of Enduring Market Leadership" noted that in the disposable diaper market a well-reviewed product called Chux predated Procter & Gamble's 1961 introduction of Pampers by decades. But P&G managed to leverage its technical and financial resources to build a position in the mass market. Likewise, in the U.S. market for light beer, several products predated the introduction of Miller Lite in the 1970s. To build market share for Miller Lite, Miller Brewing Co. was willing to spend heavily on advertising — something that Rheingold Brewery of New York didn't do with its pioneering light beer, Gablinger's.

From "The Critical Difference Between Complex and Complicated":

- If you manage complex things as if they are merely complicated, you're likely to be setting your company up for failure. That's according to the book *It's Not Complicated: The Art and Science of Complexity for Business*, by finance professor Rick Nason.

- Complicated problems can be hard to solve, but they are addressable with rules and recipes, or systems and processes. The solutions to complicated problems don't work as well with complex problems, however. Complex problems involve too many unknowns and too many interrelated factors to reduce to rules and processes.

- A technological disruption like blockchain is a complex problem. A competitor with an innovative business model — an Uber or an Airbnb — is a complex problem. There's no algorithm that will tell you how to respond.

- When facing a problem, managers tend to automatically default to complicated thinking. Instead, they should be "consciously managing complexity." That means embracing four tactics: Recognize which type of system you are dealing with; think "manage, not solve"; employ a "try, learn, and adapt" operating strategy; and develop a complexity mindset.

From "Using Scenario Planning to Reshape Strategy":

- There's an increased interest in scenario planning. Rather than tying their companies' futures to strategies geared to single sets of events, many senior executives are trying to understand multiple views about possible futures.

- Unlike approaches to scenario planning that take a probabilistic

stance (making predictions in percentage terms or as best-case/worst-case scenarios) or a normative stance (envisioning what a future should look like), the so-called Oxford scenario planning approach is based on plausibility. By recognizing the part of uncertainty that is unpredictable and by actively exploring the sources of the turbulence and uncertainty, the goal is to iteratively and interactively generate new insights to help organizations reperceive their circumstances.

- A core feature in the Oxford approach is making a distinction between the immediate business environment an organization inhabits (where business transactions take place) and the broader environment, or context, in which it operates.

- Mini case studies detail how Rolls-Royce and the Royal Society of Chemistry have used scenario planning.

From "The Flare and Focus of Successful Futurists":

- The art of forecasting the future requires simultaneously recognizing patterns in the present and thinking about how those changes will impact the future so that you can be actively engaged in building what happens next — or at least be less surprised by what others develop.

- Futures forecasting is a learnable skill, and a process any organization can master. It is meant to unite opposing forces, harnessing both wild imagination and pragmatism.

- A Six-Step Forecasting Methodology requires teams to alternate between broadening (that is, "flaring") their thinking and narrowing (that is, "focusing") it.

- Executives can spot emerging trends early on by making observations at "the fringe" of society or a particular research area rather than in the mainstream. They can uncover patterns by categorizing information on the fringe and looking for

contradictions and rarities.

Five Rules for Managing Large, Complex Projects

Recent research on megaprojects — defined as projects costing more than $1 billion — reveals five lessons that can help executives manage any large-scale project more effectively.

Andrew Davies, Mark Dodgson, David M. Gann, and Samuel C. MacAulay

August 31, 2017

"Megaprojects" — defined as projects with budgets exceeding $1 billion — are important contributors to numerous sectors, including health care, defense, mining, telecommunications, transport, energy and water infrastructure, sporting

events, science, and manufacturing. They represent a significant proportion of many nations' economic activity and profoundly affect productivity, social cohesion, and the environment.[1] Yet megaprojects have proved notoriously difficult to deliver on time and on budget; one estimate suggests 90% of them end up over budget.[2] Two prominent examples are the Sydney Opera House in Australia, which was 10 years late and a staggering 1,400% over budget when it opened in 1973,[3] and the "Big Dig" Central Artery/Tunnel Project in Boston, Massachusetts (original estimate $2.6 billion, actual cost $14.8 billion).

Why are megaprojects so difficult to

manage? The reasons include technical challenges, changes in design and operational requirements, increases in costs, disputes over responsibility, and new regulations. Complexity usually increases with project scale, and complexity can give rise to uncertainty and an inability to foresee the difficulties, changing conditions, and unanticipated opportunities that will be encountered once the project is underway. In this article, we argue that one way to manage the uncertainties is to innovate throughout the course of the project. What's more, we believe our suggestions are applicable to *all* large-scale, long-term projects — not just projects with billon-dollar budgets.

Specifically, we'll distill five rules for innovation in large, high-risk projects, providing managers with guidance on how to modify their plans and processes when opportunities arise or conditions change. Our findings are based on more than 10 years of research into megaprojects. (See "About the Research.") The projects we studied included:

- High-Speed 1 (1998-2007), a high-speed, 109-kilometer railway from London to the Channel Tunnel, which cost £5.8 billion (roughly $7.5 billion at today's exchange rates)4.

- Heathrow Terminal 5 (2002-2008), a new airport terminal, hotel, car park, subway line, and air traffic control tower, which cost £4.3 billion.

- Infrastructure for the London 2012 Olympics (2006-2012), which cost £6.8 billion.

- Crossrail (started in 2007, scheduled to open in 2018), a 118-kilometer railway across London that has a budget of £14.8 billion and includes 42 kilometers of new railway tunnels and 10 new and 30 upgraded stations.

- Heathrow Terminal 2 (2009-2014), an airport terminal now serving 29 airlines that replaced an existing terminal and cost £2.5 billion.

- The Thames Tideway Tunnel project, begun in 2016, a 25-kilometer

tunnel and an upgrade to London's sewer system; the project is
expected to take up to seven years to complete, at a cost of £4.2
billion.

About the Research

We undertook our core research on three
recent megaprojects in London —
Heathrow Terminal 5, the London 2012
Olympics, and Crossrail — between
2005 and 2015. We also drew upon
previous, adjacent, and continuing
studies conducted by one or more of the
authors, including studies of the first
phase of High-Speed 1 in 2002 and
2003, of Heathrow Terminal 2 in 2014
and 2015, and of the Thames Tideway
Tunnel from 2013 to 2016. Focusing on
the strategic management of
megaprojects, we engaged in long-term
research collaborations with sponsors,

clients, delivery partners, and major contractors.

Our methods included qualitative case studies, semi-structured interviews, and ethnographic observations. We conducted more than 170 interviews with CEOs, project directors, project managers, directors, and project team members, mainly at the project head offices but also on-site with project managers engaged in daily activities. Although the form of research engagement varied, we produced an in-depth case study of each project's approach to innovation, which was checked and verified in meetings with our partners.

Our research activities on Heathrow

Terminal 5 from 2005 to 2009 led to invitations to study the London 2012 Olympics project in 2010 and 2011 and the Crossrail project from 2011 to 2015. Since each project was completed around the time the next one began, we had a unique opportunity to observe how people, novel ideas, and practices move within and between projects. Distinct patterns of innovation emerged, and we began to recognize how innovative capabilities and processes moved from one project to the next.

Our initial work on Heathrow Terminal 5 and then the London 2012 Olympics involved observing and analyzing how innovation occurs in megaprojects. When we researched Crossrail, we

continued with our observational approach, and we were also invited to help the client develop and implement an innovation strategy for the project, which drew upon lessons learned from previous projects. Our categorization of the five rules of innovation emerged during our engagement with the three projects. They were tested at numerous academic seminars at the University of Pennsylvania, University College London, Imperial College London, University of Queensland, HafenCity Universität Hamburg, École Polytechnique, BI Norwegian Business School, and LUISS Business School.

Five Rules for Innovation

We follow the view that Donald Sull of the MIT Sloan School of Management and Kathleen M. Eisenhardt of Stanford's School of Engineering express in their book *Simple Rules: How to Thrive in a Complex World*: Management strategy in complex, uncertain circumstances is often best articulated as a series of simple rules.[5] Based on our experiences working on and studying megaprojects, here are our five rules for such projects. (See "Five Innovation Rules for Large, High-Risk Projects.")

Five Innovation Rules for Large, High-Risk Projects

The following five simple rules can help improve the performance of big, high-risk projects. These five rules encourage innovation to deal with uncertainty and confer the flexibility to change — while maintaining the stability required to deliver projects efficiently.

RULE	PURPOSES	PRACTICES
1. Assess what's worked before.	• Learning from other project sectors and research organizations • Capturing own prior experience • Evaluating risk and uncertainty	• Case studies and site visits • Recruitment of expertise
2. Organize for the unforeseen.	• Flexibility and adaptability • Changing behaviors • Risk-sharing	• Integrated client and contractor teams • Flexible contracts • Partnerships and collaboration
3. Rehearse first.	• Exploring options • Prototyping, proving, and improving • Identifying and reducing uncertainty	• Off-site tryouts • On-site tests and trials • Simulations and models • Solution development
4. Calibrate and apportion risks appropriately.	• Pairing stability and change • Managing innovative components of the project differently from standardized and predictable aspects	• Structured process to change the project plan • Contracts tailored to address uncertainty in the project and subprojects • Design is frozen progressively to deal with unexpected events
5. Harness innovation from start to finish.	• Formalizing structures and processes for guiding, shaping, creating, and using innovations	• Explicit innovation strategy statement • Establish innovation governance and leadership • Develop, capture, and share innovations

1. Assess what's worked before. When Heathrow's Terminal 5 was being planned, the project team systematically studied every international airport opened in the previous 15 years and every U.K. construction project that cost more than £1 billion built during the previous 10 years.6 One of the chief problems discovered was the use of fixed-price contracts to transfer risks to suppliers, thereby creating adversarial relationships with contractors and — worse — freezing designs at an early

stage of the project, limiting innovation. The planners of Terminal 5 calculated that if they used a fixed-price contract approach, the project would end up over budget and one year late. Endeavoring to learn from these accumulated lessons, the planners created a new delivery model based not on rigid fixed-price contracts but on a collaborative, innovative, and flexible process. Unfortunately, the public remembers the Terminal 5 project for its disastrous opening days, when more than 20,000 pieces of luggage were misplaced and several hundred flights were canceled.7 What's often overlooked, however, is that the Terminal 5 project was delivered on time and on budget, and in several subsequent years was voted the

world's best airport terminal by passengers.[8] Furthermore, the problems with the Terminal 5 opening provided important lessons guiding key improvements in the megaprojects that would follow — improvements we'll outline in greater detail below.

2. Organize for the unforeseen. While fixed-price contracts may be adequate for dealing with predictable and stable conditions, more flexible contracts are required to deal with unexpected and rapidly changing circumstances. By using cost-plus or cost-reimbursable contracts, for example, the client and contractor enter into a relational agreement where there are incentives to build trust, form a collaborative culture,

and share risks and opportunities.

True, flexible contracts can appear undesirable at first because of their higher up-front costs. But such contracts support coordination by mutual adjustment when project activities and schedules are modified in real time to address unforeseen circumstances. The client creates incentives encouraging contractors working on the project to reveal problems, recover costs, achieve agreed-upon profit margins, exploit innovative possibilities, and build solutions. The "T5 Agreement" between the client and major contractors in the Terminal 5 megaproject formed the basis of a new flexible process for dealing with uncertainty — and was

subsequently used as a model for the London 2012 Olympics and Crossrail megaprojects.

Another key to managing megaprojects is staffing project teams with innovative thinkers — and encouraging teams to remain flexible. After all, a megaproject comprises numerous smaller projects, each executed by a project team. When organized and incentivized effectively, people with different knowledge and skills can adapt and respond flexibly to rapidly changing conditions, unforeseen problems, and emergent opportunities. These teams treat existing knowledge and skills as bases from which to modify old routines and build new ones.

When it came to planning the London

2012 Olympics, the Olympic Delivery Authority exemplified the approach of using flexible project teams. One senior Olympic Delivery Authority manager told us that team dynamics depended on "having enough excellent people with a real attitude of rapid assessment and decision-making to be able to see issues, discuss them, make decisions, and move on." In addition to providing flexibility, well-organized team structures can also forge collaboration and overcome tensions that arise when companies with differing interests are expected to work together.

3. Rehearse first. The risks of cost and time overruns associated with the adoption of new technology and

practices were minimized on the Terminal 5, Olympics, Crossrail, and Terminal 2 projects by reliance on established technologies and practices. Where new technologies and practices were introduced, they were first tested and proven in off-site trials, dry runs, and other operational environments such as smaller airport terminals.

For example, the "roof project" for the main terminal building was considered one of the most uncertain parts of the Terminal 5 project. There were concerns about erecting roof abutment structures with spans of more than 150 meters. The solution was erecting these structures in advance, at an off-site location. Through the off-site pilot, project leaders

identified 140 lessons, each with a preemptive risk mitigation plan, enabling contractors to work more rapidly on-site.9 As a result, the roof project was delivered three months earlier than planned.

In contrast, the first few days of operation of Heathrow's Terminal 5 infamously suffered from a lack of rehearsal. Having learned lessons from the problems associated with the opening of Terminal 5, the leaders of the Terminal 2 project established a new rehearsal-style process for Terminal 2: a "soft" opening. Importantly, the soft opening occurred *two years* prior to the official opening of Terminal 2 in June 2014. Terminal 2's soft opening was led

by a dedicated "operational readiness" team. That team managed a gradual handover to operations, including 180 trials with 14,000 volunteers and 1,700 training sessions. The soft opening also included the creation of a "model terminal" mock-up to test check-in software. In addition, there was a test with a live flight and a staged gateway process to move each airline into a live terminal building.

Terminal 2 wasn't the only project that learned lessons from the problem-plagued opening of Terminal 5. In its planning for the London 2012 Olympics, the Olympic Delivery Authority made a point of completing its construction program by July 2011 —

providing *one whole year* of testing on live events in the run-up to the Olympic Games.

4. Calibrate and apportion risks appropriately. A megaproject contains a large proportion of predictable, standardized, and repetitive tasks that have been performed many times on previous projects — as well as novel and innovative procedures being applied for the first time. This combination requires a balancing act, and the concept of "targeted flexibility" provides a solution to it.10 The idea is to break down a megaproject into distinct projects, structures, and processes, each of which addresses a different piece of the uncertainty.

A targeted flexibility approach creates different contracts and collaborative arrangements to address the varying challenges of individual projects within the program. A cost-plus contract, as we mentioned earlier, can be used when uncertainty is high; a fixed-price contract may be more appropriate when there's less uncertainty. The London 2012 Olympics megaproject used a targeted flexibility approach to great success, relying on fixed-price contracts to deal with known conditions and risk-sharing, and target-cost contracts (including contracts based on a suite of what have been called "New Engineering Contracts"[11]) to deal with less predictable projects, such as the construction of the London Aquatics

Centre, the Velodrome, and the Olympic Stadium (now London Stadium).

Thanks in part to this approach, ISG plc, the contractor that built the Velodrome, came forward with the suggestion to switch from a steel roof to a cable-net roof, resulting in significant reductions in time and cost.12

5. Harness innovation from start to finish. Formulating a coherent statement about innovation can help project leaders plan, coordinate, and communicate with research partners and other collaborators from start to finish.13 We saw proof of this during the Crossrail megaproject, which introduced the idea of establishing an innovation strategy for the *construction* phase of

the project.

Established in 2012, the Crossrail Innovation Strategy created a formal process for encouraging members of the project supply chain to submit ideas for innovation. In collaboration with Imperial College London, Crossrail's leaders created a small team for the express purpose of identifying, evaluating, and developing new ideas — ideas developed internally or originating with members of the project supply chain. Crossrail also developed an online digital platform called "Innovate18" to provide both insiders and outsiders with a mechanism to submit ideas, including an "Innovation Management System" to manage, track,

and report on the progress of ideas. Innovations likely to benefit Crossrail thus had the chance to gain relevant sponsorship and commitment from interested parties well in advance of the actual construction. By summer 2015, the program had attracted more than 800 ideas ranging from the use of high-definition drone-mounted cameras for site inspections to the repurposing of grout shafts to cool the train tunnels by transferring heat to adjacent buildings.

The success of the program made Crossrail's leaders recognize that there would be additional advantages in starting even earlier. So when Andy Mitchell, Crossrail's program director, became CEO of the Thames Tideway

Tunnel megaproject in 2014, he decided to build upon the Innovate18 digital platform. He also recognized that it was important to involve the leaders who would manage the tunnel after construction was complete. The cost of operating a rail system, airport, or tunnel over a lifespan of several decades is much higher than the cost of designing and building it; those who will eventually maintain the asset can often identify and implement innovations during the front-end planning and design phase that will improve performance and reduce costs later on. Participants in Crossrail and Thames Tideway have developed this concept, creating an industry-wide program called i3P, which stands for

Infrastructure Industry Innovation Platform. The i3P program has been rolled out to support innovation in a number of new megaprojects.14

A More Flexible Approach

Despite the diversity of large, high-risk projects, there are some simple rules that can help improve their performance. The five rules we have described encourage innovation to deal with uncertainty. They confer the flexibility to change while maintaining the stability required to deliver projects efficiently. And they help coordinate innovative action across multiple parties. These simple rules challenge traditional project management, which has pushed too far toward control and prescription and

been characterized by complicated, highly rigid contracts that stifle flexibility and innovation. These five rules might seem like common sense, but the marked failures of past megaprojects show the value of making such sense much more common.

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Moving Beyond the Silicon Valley State of Mind

Featured excerpt from *Sensemaking: The Power of the Humanities in the Age of the Algorithm.*
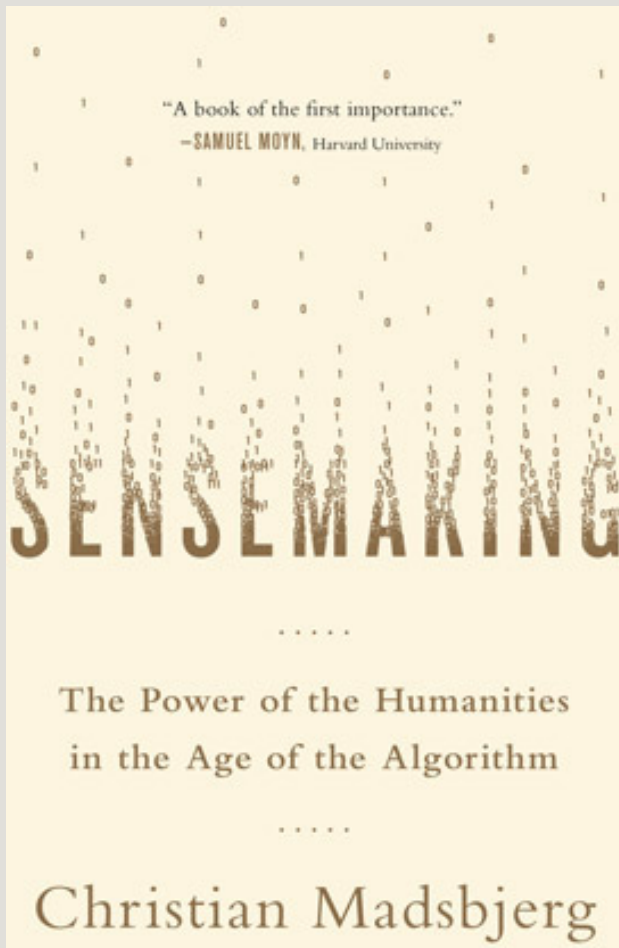
Theodore Kinni

September 18, 2017

To steal a phrase from Anton Chekhov, the great danger of the Age of the Algorithm is that we will know everything and understand nothing. In his new book *Sensemaking*, a polemic defending the need for the liberal arts in business, Christian Madsbjerg, a founder of strategic consulting company ReD Associates based in Copenhagen

and New York, argues that leaders shouldn't try to know everything. Instead, they should try to make sense of something.

Madsbjerg offers up sensemaking as the antidote to algorithmic thinking — "a Silicon Valley state of mind" that relies exclusively on data for direction. Relying on data alone is taking "a journey determined by the reductions of a GPS," according to the author. Sensemaking is the North Star: It provides the essential context for data — the rationale for collecting it and the perspective needed to gain insight from it.

In the excerpt below, Madsbjerg tells the story of Napa Valley's Cathy

Corison, comparing her approach to wine making with the data-driven approach of Leo McCloskey, founder of Sonoma, California-based Enologix, Inc., to illustrate the difference between traveling by the North Star and the GPS.

"A book of the first importance."
—SAMUEL MOYN, Harvard University

SENSEMAKING

. . . . .

The Power of the Humanities in the Age of the Algorithm

. . . . .

Christian Madsbjerg

An excerpt from

Sensemaking: The Power of the Humanities in the Age of the Algorithm

by Christian Madsbjerg

Reprinted by permission of Hachette

Just off Route 29 in California's Napa Valley, a gray barn with the clean architectural lines of another era stands watch over several acres of St. George rootstock vineyards. A knotted rope swing hangs in front of the property, and one lone Prius is parked in the small lot. This is the Corison Winery, home to the venerable Cathy Corison, a winemaker who has been making Napa Valley Cabernet on her own terms for close to 40 years.

Though the interior of the barn is humble — there is no formal tasting room, and picnic tables holding wine bottles and glasses sit side by side with

wine tanks and wood barrels — Corison exudes a quiet power when she comes out to meet me. Now in her early 60s, Corison has earned her stripes in the Napa Valley community. After graduating with a master's degree in enology from the University of California at Davis, the country's preeminent wine studies program, she started working in the Napa Valley.

In the years following Prohibition, the wine industry in the Napa Valley consisted of a few sleepy vineyards and a lot of sweet wine. The modern wine industry as we know it began to emerge in the mid-1960s, supported by research done at the University of California. Then, in 1976 — right after Corison

showed up in Napa — the wine world, dominated by the French, was stunned when California's wines bested their French counterparts in a blind tasting with French wine critics. Napa Valley became a hotbed of activity with the emergence of new wines and new ways of making wine. Unlike the traditional European vineyards, American winemakers fully embraced technology like cold fermentation: by placing the grapes in a stainless steel vat with double walls, the winemakers were able to pass a coolant through them to control the fermentation, leading to fresher and crisper American white wines.

Corison came of age when these types

of new technologies were emerging. She and her fellow UC Davis graduates initially approached wine making through the lens of their technical training, holding the older growers in disdain for their lack of scientific knowledge. Now, four decades later, Corison sees things differently. "There was a lot of wisdom from the old-timers. We were full of ourselves, but the more you know the less you know."

By the late 1980s, Corison had been making wine for the famous label Chappellet for close to a decade. The vineyards of Chappellet, up in the hills of Napa Valley, had gone through a few seasons of drought, so Corison and her team sourced some additional grapes

from down on the Rutherford Bench. This "bench" is made up of well-drained alluvial soils, unlike the rocky terrain up in the hills. Most important, the bench is gravelly loam — composed of roughly equal parts of sand, silt, and clay — so it has great water-holding capacity but excellent drainage. Vines in loam soil get the water they need to grow in the spring and summer. Gravel makes the soil well drained so when the rains stop coming, the vines stop growing and focus on ripening.

"If Cabernet is growing when it ought to be ripening its fruit, it maintains green flavors," Corison explained. Ripeness in Cabernet Sauvignon is marked by the evolution of red, blue, purple, and black

fruit flavors and the disappearance of green notes. "If the vine stops growing and gets busy ripening, however, there is a chance to get grapes fully ripe without the sugars getting too high."

When Corison and her crew began sourcing grapes from these alluvial loam soils, she had a revelation about the kind of wine she wanted to make. "There was a wine inside me that needed to get out," Corison told me. "That's the only way I can describe it. It was both powerful and elegant. Cabernet is going to be powerful no matter what you do, but it's way more interesting to me at the intersection of elegance. When we sourced grapes from down in the valley, I learned that this wine that needed to

get out grows on the Rutherford Bench."

Starting in 1987, Corison embraced this vision and began making her own wines. She found wineries with excess capacity and used their facilities to create her Napa Valley Cabernet. In 1995, she and her husband bought a small plot of land that runs from Rutherford to St. Helena. Everyone else had turned down the land because they assumed that the vines would need to be replanted and the old property on it torn down. Corison and her husband forged ahead, turning the derelict property into a barn to house their facility. And they did not replant the old vines on St. George rootstock. Instead, they celebrated them.

"Those vines are just wise — they are old and wise. I think it has to do with root depth. They come through heat spells with grace and style when all the younger vineyards are really hurting. They know what to do."

During this time, the fashion in Napa Valley was big and bold. New World winemakers in California tended to let the fruit sit longer on the vine for powerful aromas and flavors. The alcohol levels of these wines began to stretch well above 14 percent. Some critics lauded them as "lush," while others derisively referred to them as "fruit bombs." In the late 1980s and early '90s, Napa Valley looked less and less like an agricultural community and

more and more like a playground for the rich and famous. The lushness of the wines reflected the grandiosity of these drinkers.

The "numbers" of these more robust wines were all scientifically correct. The wines were all technically sound, with structural integrity. The winemakers could clearly state the properties of their "ripe" wines: the sugar, acid, and pH levels of the grapes all measured in an appropriate range.

The aspects of ripeness, however, tell a much more nuanced story. "Ripeness happens at different numbers every year," Corison explained. "If you are not out in the vineyard, seeing it, you don't really know. Numbers are just a piece of

it. The vines get tired by the end of the ripening season and can give up after a while. And when they give up, true ripening ends. That is the challenge: to make all the components converge at just the right time. A great vintage is when all those factors converge right where you want them. It's biology and chemistry, but also alchemy. There is so much we don't understand on a technical level."

Every single word Corison uses to articulate her wine and her wine making conveys her relationship to the land. These vines are not measured in scientific properties: the pH, salinity, and lime content of their soil suitability, for example. Instead, she describes them

as "old and wise," with "grace and style."

"We have all the heat and sunshine we need to get the grapes right — even in a cold season like 2011 — but because of the cold nights and the fog coming in, we have beautiful natural acidity too. And the tannins in [this] corner of the world come in feeling like velvet. If you were to measure the tannins, you'd get a very big number. But tannins are not one molecule; they're a class of molecules that can range from harsh and astringent to soft and velvety and beautiful. And that is what I love about benchland fruit: There are fruit flavors, but the tannins are so luscious. They feel good."

Corison could never gain this type of perspective from a spreadsheet or an office on the 87th floor of a skyscraper. She knows the tannins feel like velvet because she has been tasting them for close to 40 years. Ultimately, she can hold this aesthetic judgment because of how specifically she is situated in her context. To put it simply, Cathy Corison gives a damn: "I cut my teeth on European wines. And I tasted enough of the old Cabernets from that neck of the woods to know elegance. It's a moral imperative for me to make a wine that will be long-lived and do interesting things in the bottle."

When you have a perspective — when you actually give a damn — you

intuitively sense what's important and what's trivial. You can see what connects with what, and you know the data, input, and knowledge that matter. Caring is the connective tissue that makes all these things possible.

Conversely, a lack of care is often at the root of many of the business and organizational challenges I encounter in my consulting. Over time, as management has become increasingly professionalized, you can sense a kind of nihilism or loss of meaning in the executive layers. This nihilism is strongest in large corporate cultures where management is seen as a profession in and of itself, with no strong connection to what the company

actually makes or does. What happens when satisfaction in work comes from managing — reorganizing, optimizing the operation, hiring new people, and making strategies — and not from producing something meaningful? How do you feel when it doesn't really matter whether you make beauty products, soft drinks, fast food, or musical instruments?

Without care, everything is "correct" and nothing is "true." Martin Heidegger claimed that care — or what he called Sorge — is the very thing that makes us human. He didn't mean "care" as an explicit emotional connection with things or people, but rather in the sense that something matters to you, is

meaningful to you. It is this care that enables us to interact with stuff in very complex ways, and it is also this care that enables us to see new ways of interacting with the world.

If you are in the beauty business, you simply can't make sense of cultural insights regarding beauty ideals if you don't care about the meaning of beauty products. If you are in the car industry, you have to care about cars and transportation — otherwise, the human phenomenon of driving will not make sense to you. Without care, you stop seeing the bigger picture of meaning and insight and you only see discrete data points — what Isaiah Berlin referred to as "so many individual butterflies."

Care is what allowed Cathy Corison to hear the call of the wine trying to "get out" of her. And care is what gives her the courage to continue to make it, year after year after year. Today it is in fashion. Ten years ago, it was not. Care provides her with a North Star so she doesn't get distracted or waylaid throughout these cycles of wine and culinary fashion.

Consider Leo McCloskey, founder of a wine consulting group called Enologix. Whereas Cathy Corison's wine is never just about the numbers, McCloskey has developed an entire business model around the belief that wine making is all about numbers. With the world's largest wine database, he tastes hundreds of

wines a year and then breaks all of them down into the individual compounds that give them their unique color, flavor, and fragrance.

What does he do with all this information? He begins by running computer tests for his clients to help determine the most important moment of the season: when to pick the grapes. This reverse-engineers the wines, stripping them down to their component parts and atomizing each and every element. These results get compared with his vast database — calculated along with captured data about conditions in the vineyard, such as the rainfall and water levels and wine-making process details like the types of

barrels used and the length of fermentation. All of these models give winemakers a way to create virtual versions of their wine: playing with different factors to tweak particular elements, akin to creating a Fantasy Football League.

When the wine is ready to go in the bottle, Enologix has one final offering: Their calculations can predict with a fair amount of accuracy how the wine will score on the infamous 100-point scale in *Wine Spectator*.

It's a *Moneyball* approach to wine making, an audacious move in a culture that holds firmly to its identity as an artisanal craft. McCloskey does not reveal the names of his clients, but he

primarily serves the smaller vineyards attempting to stay close to the traditional methods of wine making made famous in old-world cultures like Burgundy and Alsace. These clients, and several sources in the industry, believe that McCloskey has something valuable to offer winemakers. But anyone who spends time with Cathy Corison knows that this value is a mirage. Nothing in McCloskey's "black box" has any lasting point of view. By taking an entirely objective approach to the data — and treating the compounds in a bottle of wine as atomized elements discrete from their greater context — McCloskey has every chance of helping to make good wine today. But he will never come close to making great wine

that endures. This is because there is no integrity, no aesthetic — there is no person who cares — behind the choices. It is technical precision with no soul.

If Cathy Corison tried to game her bottles using a data-crunching algorithm in the Enologix system, she might optimize a single year for a better wine score. But it would be at the cost of a much more compelling — and impressive — trajectory. "One of the things I love about wine is that it speaks of time and place, and marches forward speaking of time and place. These wines are still talking about what was happening," Corison told me. "I feel a moral obligation to make wines that let the dirt speak."

By making such wines for 30 years, Corison's vintages have remained remarkably consistent over the years. She doesn't add acid, tannins, enzymes, or any of the oak flavors. The wine that was dying to get out of her was based entirely on the grapes themselves. When you drink Cathy Corison's wine, you are experiencing everything she cares about: a profundity of data that can never be captured in an algorithm. Machine learning can never understand how she prevailed despite falling in and then out of style. And entering all the sense data possible wouldn't get at the meaning of her perseverance. Computers simply do not give a damn; they will never understand that caring is the whole point.

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12 Essential Innovation Insights

For decades, researchers have published their findings about innovation in *MIT Sloan Management Review*. Here are a dozen of the best insights.

Bruce Posner and Martha E. Mangelsdorf

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Innovation is a perennial management challenge. That's why, for decades, *MIT Sloan Management Review* has been publishing new research and insights about innovation — from top researchers at business schools as well as from leading business executives and

consultants.

For this article, we tapped into that knowledge base. We combed through our archives, looking for older articles with innovation insights that today's *MIT SMR* readers might have missed but that still retain wide relevance. We then winnowed down our list of articles and set out to distill 12 key innovation insights from the *MIT SMR* archives into a succinct format.

We present those selections here, in capsule form, so you can browse through them easily. But you can also dive deep into any of these articles; we've assembled all the articles mentioned at http://sloanreview.mit.edu/tag/essential-innovation-insights.

Innovation Insight 1

Innovation isn't necessarily about new things; it's about new value.

Innovation isn't just about developing new products or technologies. In a 2006 *MIT SMR* article "The 12 Different Ways for Companies to Innovate,"[1] Mohanbir Sawhney, Robert C. Wolcott, and Inigo Arroniz encouraged executives to think broadly about what types of innovation are possible. The authors noted that companies within the same industry "tend to innovate along the same dimensions" — whether those dimensions are research and development (R&D), process innovations, or branding. Viewing innovation too narrowly, the authors pointed out, "blinds companies to

opportunities and leaves them vulnerable to competitors with broader perspectives." Sawhney, Wolcott, and Arroniz used examples such as Starbucks, which initially innovated not by producing a different product but instead by creating a different kind of customer experience — what the company termed a "third place" for gathering that was between home and work.

Business innovation, the authors stressed, has to do with new value, not necessarily new things — and comes in many flavors. The authors presented an "innovation radar" so companies can consider 12 different areas in which they might innovate — ranging from method

of value capture to operating processes to platforms. "When a company identifies and pursues neglected innovation dimensions, it can change the basis of competition and leave other firms at a distinct disadvantage," the authors concluded.

Innovation Insight 2

Challenge competitors by playing a different game.

Technological disruption is one way to upend a market, but it isn't the only way. For some companies, the secret, according to Constantinos Markides of London Business School, is to change the rules of the game.

In researching his 1997 article

"Strategic Innovation,"[2] Markides studied more than 30 companies that had successfully attacked leaders in their industry without the benefit of a breakthrough technological innovation. The common element in such successes, Markides found, was that the attacker changed the rules of the game, a phenomenon he termed "strategic innovation." For example, Southwest Airlines changed the rules of the airline industry when it chose to fly its planes point-to-point rather than through hub cities. "Strategic innovation occurs," Markides wrote, "when a company identifies gaps in the industry positioning map, decides to fill them, and the gaps grow to become the new mass market."

Markides offered a framework for thinking about strategic innovation that's grounded in three basic questions: Who are your customers? What products or services should you offer them? And how should you offer them? To change the rules of the game in their industry, Markides noted, companies can either redefine the business, redefine who their customers are, redefine what they offer customers, redefine how they do business, or start the strategic thinking process at a different point — for example, the organization's unique capabilities.

Of course, coming up with new ideas for strategic innovation does not guarantee success. "It's worth reemphasizing that

coming up with new ideas is one thing; succeeding in the market is another," Markides wrote.

Innovation Insight 3

Focus on identifying and resolving uncertainties in innovation projects.

Breakthrough innovation projects necessarily involve a high degree of uncertainty, Mark P. Rice, Gina Colarelli O'Connor, and Ronald Pierantozzi observed in their 2008 article, "Implementing a Learning Plan to Counter Project Uncertainty."[3] So, rather than try to apply disciplined planning techniques to such innovation projects, they proposed that companies focus on identifying and prioritizing the uncertainties that need resolution.

The authors developed a framework for turning uncertainty into learning by studying large innovation projects at 10 technology-intensive companies, including GE and IBM, over a period of seven years. They concluded that, in breakthrough projects where the shape of the future market has yet to be determined and where it's unclear which applications will succeed, identifying milestones to achieve may not be the best approach. "In such scenarios," Rice, O'Connor, and Pierantozzi wrote, "it is more reasonable and useful to identify and prioritize uncertainties that must be resolved, to define alternative approaches to exploring them, and to continually assess the value of cumulative learning compared to the

costs incurred."

Rice, O'Connor, and Pierantozzi suggested that companies develop what they call a "learning plan" to help teams examine four types of uncertainty: technical, market, organizational, and resource. Managers can use the process, the authors wrote, "to uncover gaps in knowledge and create a record of what is known, to prioritize which uncertainties are most critical and propose alternative assumptions about the reality behind each uncertainty, and to find ways to test assumptions and resolve the uncertainties as quickly and inexpensively as possible."

The authors provided some helpful suggestions about how to apply their

approach effectively. Rather than approaching the process in a linear fashion, they called for multiple passes, or "learning loops," to allow teams to review results, clarify assumptions, and identify new tests to initiate. A critical aspect of the approach, they argued, is proper oversight by people with experience in highly uncertain projects. One risk of using people without such experience is that they may kill promising projects too early.

Innovation Insight 4

Remember that being first to market is no guarantee of success.

One of the most enduring axioms of business is that, irrespective of whether you're running a startup or an

established company, it pays to be first to market. But as authors Gerald J. Tellis and Peter N. Golder explained in a 1996 article titled "First to Market, First to Fail? Real Causes of Enduring Market Leadership,"4 the case for entering the market before anyone else can be — and often is — overstated and distorted by the nature of the data. The authors pointed out that previous studies finding that pioneering companies gained an advantage had only surveyed surviving pioneers.

The authors studied the history of 50 consumer product categories and found that pioneering companies had a high failure rate: 47%. Importantly, the authors found that being a market

pioneer was less advantageous from a market-share perspective than being what they called an *early leader*, one who enters the market after pioneers but becomes a leader in the market's early growth phase. Early leaders, the authors wrote, tend to have low failure rates and significantly higher market shares than pioneers.

Tellis and Golder found that the early leaders they studied excelled in comparison to pioneers on five factors. Early leaders had a "vision of the mass market" for the product; they persisted through business challenges; they were able to commit resources in line with their vision; they innovated relentlessly, even if it meant risking (or

cannibalizing) their other products; and they leveraged their assets. In the disposable diaper market, for example, a well-reviewed product called Chux predated Procter & Gamble's 1961 introduction of Pampers by decades. But P&G managed to leverage its technical and financial resources to build a position in the mass market. Likewise, in the U.S. market for light beer, several products predated the introduction of Miller Lite in the 1970s. To build market share for Miller Lite, its parent company was willing to spend heavily on advertising (something one of the market pioneers, Gablinger's, didn't do).

The takeaway, Tellis and Golder

concluded, isn't that it's better to be a follower than a pioneer. It's that paying attention to the five leadership factors will have more impact on long-term success than whether or not you enter the market first. "Being first," they wrote, "does not automatically endow an advantage; it only provides an opportunity."

Innovation Insight 5

Let your customers develop your next product.

When developing new products, how do you determine what customers want and what they need? This, of course, is a classic challenge, one that managers have labored over for many years. But in a 1977 article titled "Has a Customer

Already Developed Your Next Product?"[5] Eric A. von Hippel of the MIT Sloan School of Management pointed out that many companies fail to take into account critical information that's available to them. In studying manufacturers of scientific instruments and process equipment, von Hippel identified a pattern: "Most of the innovative products commercialized in those industries were invented, prototyped, and used in the field by innovative users before equipment or instrument manufacturing firms offered them commercially." Von Hippel found further that "the manufacturer who takes advantage of user efforts needs only to contribute product engineering work to obtain a first-to-market product

innovation."

Users are willing to do innovation work and provide valuable information, von Hippel wrote, if they need the new product "as much as or more than you do." This can save companies a good deal of money. A big challenge, though, is convincing internal people to accept the validity of information and ideas that come from the outside.

Von Hippel further explored the "user innovation" theme in subsequent *MIT SMR* articles, including "The Age of the Consumer-Innovator,"[6] which he coauthored with Susumu Ogawa and Jeroen P.J. de Jong in 2011. In that article, von Hippel, Ogawa, and de Jong reported on new national surveys

finding that individual consumers play an important role in both creating and modifying products. What's more, the authors noted, advances in areas such as computer-aided design tools and 3-D printing mean that "consumers should realize that it is getting progressively easier to design and make what they want for themselves." Businesses, von Hippel, Ogawa, and de Jong advised, "need to think about how to reorganize their product development systems to efficiently accept and build upon prototypes developed by users."

Innovation Insight 6

Think of invention as a process of creating new combinations of elements — with results that have a highly skewed distribution.

In a fascinating 2007 article titled "Breakthroughs and the 'Long Tail' of Innovation,"[7] Lee Fleming explored the dynamics of invention. Defining invention as a "new combination of components, ideas, or processes," he explained that invention samples show an extremely skewed distribution, with the vast majority of inventions being useless, a few having some value, and only a very few representing breakthroughs.

As a result, Fleming argued that if companies want to achieve breakthroughs they should: (1) make lots of "shots on goal," since only a few of the inventions they come up with will be breakthroughs; (2) try to increase the

average value of each invention; and (3) increase the variability of the ideas they explore — in other words, "take wild shots at a rich target (or preferably a set of rich targets) because the wider range will be more likely to contain scores of maximum values."

Taking such "wild shots" is one spot where lone inventors come in. Fleming's research indicated that inventors "working by themselves can be the source of more failures as well as more breakthroughs." On average, lone inventors are not as creative or as successful as innovative teams — but, paradoxically, the loners are more likely to be the source of breakthroughs because the value of their inventions is

so highly variable. One challenge for companies, then, is finding ways to support and manage their lone inventors.

Innovation Insight 7

Understand your options for working with external innovators.

Knowing when and how to open up product development to outsiders is difficult. Which approach is better, working with external innovators organized into collaborative communities (as typified by Linux and other open-source software projects) or tapping into the competitive marketplace for products and services to complement your product? According to Kevin J. Boudreau and Karim R. Lakhani, it depends. In their 2009 article

titled "How to Manage Outside Innovation,"[8] the authors wrote that the decisions companies make about external innovation should be based on clarity about (1) the type of innovation they need from outside innovators; (2) the motivations of the outside innovators; and (3) the nature of the company's business model.

The Type of Innovation

Some forms of innovation are simpler to manage than others. When the technology and consumer preferences are clear, Boudreau and Lakhani wrote, companies generally don't need external innovation: They can develop products internally or hire contractors. However, in cases where some of the design elements are still being determined,

opening up the innovation process can lead to significant benefits. Collaborative communities generally work best when dealing with problems that draw on cumulative knowledge that extends beyond what individuals are likely to know. Competitive markets, according to Boudreau and Lakhani, are better suited for problems that would benefit from "broad experimentation across a set of technical approaches or customer groups."

The Innovators' Motivations

Just as there are different forms of outside innovation, managers need to recognize that what motivates external innovators varies. Participants in competitive markets tend to be motivated by extrinsic factors such as

financial rewards, while collaborative communities involve a greater emphasis on intrinsic rewards, such as intellectual challenge. When evaluating whether to work with collaborative communities or competitive markets, companies should be aware of the different motivators and consider the type of mechanisms needed to align with them.

The Business Model

The third issue managers need to take into consideration when deciding to open their products to external innovation is how that will affect their company's business model. In determining whether to work with a collaborative community or a competitive market, the authors noted that it's helpful to ask, "Who sells to

whom?" The answer will affect the income streams, the company's relationship with its customers, and the future role external innovators will play.

Opening your product to external innovation means that it will become a platform, Boudreau and Lakhani explained, and executives must decide which type of platform business model makes the most sense for their business. Companies can either integrate external innovators' work into their platform, allow external innovators to sell products on top of the platform, or create two-sided markets where external innovators and customers can interact.

Luckily, the authors noted, a company's innovation strategy needn't be "cast in

stone." As the needs of the business change, the innovation strategy can change as well. Initially, for example, Apple had a small group of partners producing applications for its iPhone. But within a matter of months, outside developers had developed more than 100 unauthorized applications, prompting Apple to rethink its decision and to establish licensing terms and revenue-sharing arrangements. The lesson, Boudreau and Lakhani wrote, is that "a company needs to tailor its particular approach to the context of its specific business."

Innovation Insight 8

Create systems and structures that support ongoing innovation.

The most innovative companies know how to do more than simply produce occasional winners. As Scott D. Anthony, Mark W. Johnson, and Joseph V. Sinfield explained in their 2008 article "Institutionalizing Innovation,"9 companies that are seasoned innovators have a set of capabilities that can take them from a plan for growth all the way through execution.

The authors developed their insights into innovation from interviews at more than 40 organizations in an array of industries, a survey, and fieldwork at more than 50 companies. They found that "companies that create blueprints for growth, construct innovation engines, and support the engines with

the right systems and mindsets can establish favorable conditions for substantial innovation."

So, how can companies move in this direction? As a starting point, management needs to develop a "growth blueprint" that articulates what the company "wants to be" — and the specific options it will and won't consider to reach its objectives.

Another important element, according to Anthony, Johnson, and Sinfield, is determining how the company wants to allocate resources — both money and time — to satisfy its growth objectives. One approach is balancing the innovation portfolio with a mix of improvements to the core business,

extensions to it, and growth initiatives in new areas. If a company fails to consciously allocate innovation resources among different types of projects, the authors noted, it will often end up with mostly incremental innovation projects. What's more, "if the core business runs into trouble, there is an overwhelming temptation to tap resources that the company has allocated to more speculative ventures in order to save the company," they wrote. "In the short run, this may make perfect sense; in the long run, it can be disastrous."

Although Anthony, Johnson, and Sinfield highlighted numerous questions that would-be innovators need to

confront, they were careful not to be overly prescriptive about the answers. Even within a single company, they argued, managers should be prepared to manage and measure different types of growth opportunities differently.

Companies also need to construct what the authors called "an innovation engine" — which involves structures to screen, develop, and oversee innovative projects. The authors pointed out that there are a number of different innovation structures that companies can use.

Innovation Insight 9

Connect the people in your organization who identify new ideas with those who can commercialize them.

Companies are increasingly trying to bring outside ideas into their innovation processes. To do so effectively requires an understanding of two types of innovation brokers, according to Eoin Whelan, Salvatore Parise, Jasper de Valk, and Rick Aalbers. In their 2011 article "Creating Employee Networks That Deliver Open Innovation,"10 the authors drew on research they had conducted on the diffusion of innovative ideas through personal networks in companies. Whelan, Parise, de Valk, and Aalbers explained the importance of both "idea scouts" and "idea connectors." Idea scouts excel at identifying novel external ideas, often via the web. But, to effectively implement such ideas, the external focus

of idea scouts needs to be complemented by interactions with employees who have extensive networks and influence within the company and a broad knowledge base — a group the authors called idea connectors.

Many R&D leaders pursuing external ideas through open innovation tend to emphasize only the role of idea scouts — which the authors see as a mistake. Companies, they advised, should be thinking about formal mechanisms that bring idea scouts and idea connectors together. "Promising ideas," the authors wrote, "will not mature into innovative outcomes unless they reach the parts of the employee network that have the expertise and influence to exploit them."

Innovation Insight 10

Innovation doesn't have to entail major breakthroughs; it can also involve making new product development faster and cheaper.

According to Peter J. Williamson and Eden Yin, Chinese companies are tackling innovation in a fundamentally different way: Rather than going for major breakthroughs, they aim for faster development cycles. For their 2014 article "Accelerated Innovation: The New Challenge From China,"[11] Williamson and Yin studied more than 20 Chinese companies in a variety of industries and found that by breaking the innovation process into small steps and parceling it out to teams, companies were able to complete projects and deliver results faster. These companies,

the authors wrote, are "pushing the boundaries of systemization and scale to a whole new level in their efforts to accelerate innovation, leverage the potential of a large pool of competent but often unexceptional technicians and engineers, and reduce costs."

For example, an outsourcing company serving the pharmaceutical, biopharmaceutical, and medical device industries was able to complete projects two to five times faster than comparable projects using conventional techniques. Similar gains were achieved by Lenovo Group Ltd., which had acquired IBM's personal computer business. By breaking product designs into modules handled by small teams in parallel, it

managed to cut its new product development cycle time in half. Williamson and Yin acknowledged that many of the processes and techniques used by Chinese companies are also being employed by technology companies in places like Silicon Valley. What's significant, they wrote, is how Chinese companies are bringing "accelerated innovation, with rapid scale-up, low cost, and 'good enough' quality" to many different industries.

Innovation Insight 11

Make customer communities your allies.

It's common for companies to solicit ideas and feedback from their customers and then incorporate what they learn into future products and services. But

few have taken customer knowledge as seriously or as far as the Lego Group. In recent years, the Danish toy company, whose multicolored plastic construction toys have been popular with children for decades, has actively explored new and productive ways to engage with the users of its products. As Yun Mi Antorini, Albert M. Muñiz, Jr., and Tormod Askildsen noted, "Through trial and error, Lego has developed a solid understanding of what it takes to build and maintain profitable and beneficial collaborations with users." These collaborations have led Lego to surprising new areas of growth, the authors wrote in their 2012 article "Collaborating With Customer Communities: Lessons From the Lego

Group."12

Historically, Lego built products for younger children, but in the 1990s, it unveiled a new series of products that appealed to older users. At the same time, the internet facilitated the growth of Lego user groups consisting of adult Lego fans. Lego user groups expanded globally, and innovative products produced by users (for example, a computer-aided design software program for designing Lego models) began appearing. As the authors pointed out, many of the innovations from fans "improved and extended the Lego building system or introduced new ways to use it that dovetailed well with how Lego itself thought of its products." The

company began reaching out to the fan community to solicit marketing ideas or feedback on products in development.

Collaborating with users has it challenges. At times, Lego management found that adult fans lost sight of the fact that the company's primary end users were children, not adults. In some cases, fans suggested applications that went "beyond the parameters of what the products were designed for."

From its experience working with its user groups, Lego developed a number of principles for working with customers in product development. One key lesson was the importance of setting expectations up front. After all, users may be eager to contribute their time,

but they also have busy lives. (This includes being as clear as possible about the company's parameters for when projects are expected to begin and end.) Another lesson management learned was that relationships can't be one way: They need to be not only good for the company but also rewarding for users. "Instead of regarding collaboration as something that needs to be managed exclusively by the company," the authors wrote, "it is fruitful to think of it as an ongoing dialogue between two allies. Both sides contribute important resources to a common purpose. Frequently, the two sets of resources complement each other and advance the conversation and collaboration."

Innovation Insight 12

Don't antagonize your creative people.

In the past, corporate managers often rose through the ranks and thus were very knowledgeable about the activities they supervised. But the rapid changes brought about by technology have created a widening gulf between the expertise of managers and specialized technical employees — something Robert D. Austin and Richard L. Nolan warned that companies aspiring to be technologically innovative will need to address or suffer the consequences. In a 2007 article titled "Bridging the Gap Between Stewards and Creators,"13 they wrote: "Being a good supervisor traditionally meant encouraging sound business practices and introducing changes to those practices as conditions

changed. … Now the changes sometimes come from key employees whose work managers don't completely understand."

Conflicts between business-oriented managers and technical employees aren't new. Almost 50 years ago, management guru Peter Drucker highlighted both the importance of knowledge workers and the challenges companies face in managing them. From a study of the development of the internet and interviews with internet pioneers, Austin and Nolan saw how misunderstandings between business-oriented managers (whom the authors called "stewards") and highly skilled technical employees (whom they termed

"creators") caused delays in the adoption of new technologies. The stewards were most concerned about efficient allocation of resources. Creators, on the other hand, were less concerned about overall efficiency and what was in the business plan and more focused on what they saw as a "higher purpose" and vision.

To a certain extent, Austin and Nolan concluded, disputes between stewards and creators are an inevitable — even useful — part of the innovation process. The challenge, they explained, is learning how to manage the tension, for which they put forth a set of guidelines. One of their guidelines for managers is to avoid antagonizing creators, even if it

means putting up with someone who is difficult to manage; an effort to get rid of one creator could snowball into losing two or three, leaving the company short on key creative talent. As Austin and Nolan wrote, "Putting up with a certain amount of maddening behavior by creators may be a price worth paying to keep great talent." Another recommendation is to cultivate people who can speak the language of both creators and stewards — they may be helpful in mediating internal conflicts.

"The challenges in managing someone who never wants to do the same thing twice and who keeps going off on tangents are substantial and quite

different from the more traditional challenges" managers face, the authors observed. But managers who don't learn how to manage creators run the risk of missing big opportunities, and they "won't have much fun in the process, either."

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The Critical Difference Between Complex and Complicated

Featured excerpt from *It's Not Complicated: The Art and Science of Complexity for Business*

Theodore Kinni

June 21, 2017

It's time to call out the real culprit in far too many business failures — Dr. Peter Mark Roget and his insidious thesaurus. Roget is long dead, but his gang of modern-day editors still assert that the words "complex" and "complicated" are synonyms. Unfortunately, as Rick Nason, an associate professor of finance

at Dalhousie University's Rowe School of Business, ably explains in his new book, *It's Not Complicated*, if you manage complex things as if they are merely complicated, you're likely to be setting your company up for failure.

Complicated problems can be hard to solve, but they are addressable with rules and recipes, like the algorithms that place ads on your Twitter feed. They also can be resolved with systems and processes, like the hierarchical structure that most companies use to command and control employees.

The solutions to *complicated* problems don't work as well with *complex* problems, however. Complex problems involve too many unknowns and too

many interrelated factors to reduce to rules and processes. A technological disruption like blockchain is a complex problem. A competitor with an innovative business model — an Uber or an Airbnb — is a complex problem. There's no algorithm that will tell you how to respond.

This could be dismissed as an exercise in semantics, except for one thing: When facing a problem, says Nason, managers tend to automatically default to complicated thinking. Instead, they should be "consciously managing complexity." In the excerpt that follows, which is edited for space, Nason explains how.
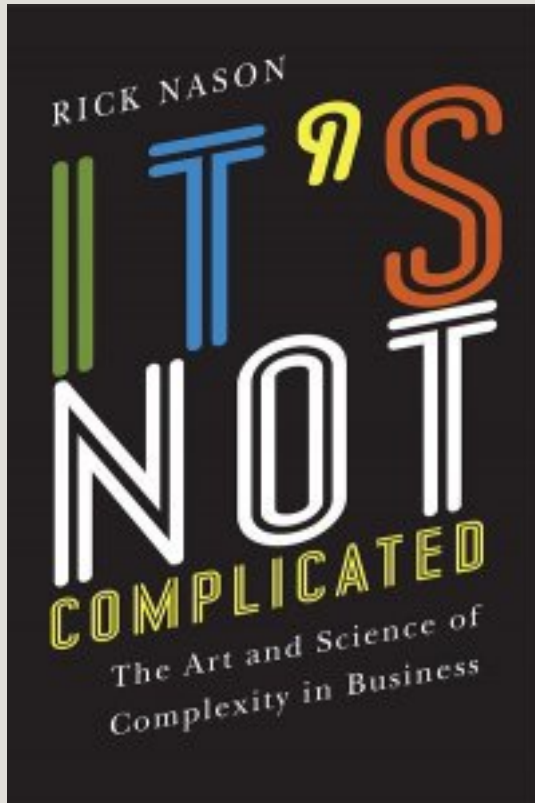
An excerpt from Chapter 5 of

It's Not Complicated: The Art and Science of Complexity in Business (Rotman-UTP Publishing, 2017)

by Rick Nason

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Consciously managing complexity in a business context is broadly a function of four different strategies or tactics. They are: (1) recognize which type of system you are dealing with; (2) think "manage, not solve"; (3) employ a "try, learn, and adapt" operating strategy; and finally, and perhaps most importantly, (4) develop a complexity mindset.

Identify System Type

Before anything can be managed, it must be recognized for what it is. This is especially important for complex versus complicated systems. The manager needs to consciously take a mental step back and classify the issues. It is relatively straightforward to ascertain which elements of the situation are

simple, which are complicated, and which are complex. Simply getting the context correct automatically sets the manager on a better course for success.

Obviously, each type of issue needs to be managed in a way that is consistent with its characteristics. Simple systems need to be managed as simple systems. Well-known recipes, procedures, or rules of thumb need to be followed and adhered to. In his bestselling book *The Checklist Manifesto*, author Atul Gawande makes a compelling case for using simple checklists as a way to manage simple systems. Dr. Gawande would likely argue that even your grandmother should follow a recipe for baking her favorite cake. Simple

systems are generally easy to manage, but that also can produce hubris that leads to mistakes.

Complicated systems require more expertise in their management, but as long as the proper expertise is available and used, the attractiveness of complicated systems is that they generally can be successfully managed. Complicated systems, by definition, adhere to a comprehensive and robust set of axioms and rules, and thus it is a matter of making sure that the proper models are being used for the situation at hand. The handling of complicated systems can be managed by the appropriate teams of experts.

Complex systems are nuanced and

require a nuanced approach. The one thing that will not work is a rigid, rules-based, complicated approach. Taking the time to make an accurate judgment about the type of management problem at hand helps to avoid the arrogance of complicated thinking. Complicated thinking leads managers to think that they are doing something purposeful when in reality they are not, and in fact they are likely doing more harm than good.

Almost everyone is familiar with the beginning of the serenity prayer by Reinhold Niebuhr. It goes, "God, grant me the serenity to accept the things I cannot change; courage to change the things I can; and wisdom to know the

difference." When dealing with the differences between complicated and complex systems, the prayer could be modified to read, "God, grant me the serenity to accept the things that cannot be calculated; courage to calculate the things that can be calculated; and wisdom to know the difference."

Having the wisdom to know which system is appropriate and the courage to apply the proper techniques for that system are the first and perhaps the most effective steps to gaining competitive advantage with complexity.

Think "Manage, Not Solve"

Complex situations do not lend themselves to a solution, and it is folly

to spend the time, energy, or effort even to attempt to create solutions. Yet this is exactly how the complicated way of thinking works. It is in evidence when companies try to optimize complex activities such as marketing strategy, production schedules based on demand, or long-range planning. This form of thinking is especially evident in economics, as politicians all promise solutions to economic ills. [Instead] the key is to think "manage, not solve."

"Manage, not solve" may be a humbling strategy to use but a lack of humility might be one of the reasons why managers default to complicated thinking. "Manage, not solve" can also be an unsettling strategy to use, as it

implies that you have to rely on your in-the-moment thinking. "Manage, not solve" is based on a strategy of thinking and making relatively spontaneous decisions under uncertainty. The assumption in the complicated world is that knowledge facilitates control, while "manage, not solve" implies uncertainty. It also implies that true answers can only be experienced with hindsight. Unlike in a situation of total randomness or chaos, where any action of management is as good as any other, complexity implies that there is a level of control available; but it is not complete control, and the situation is not completely manageable. This mode of management can be quite stressful if the manager has a complicated mindset that

abhors ambiguity and uncertainty.

"Manage, not solve" does not imply that managers should not plan in the face of complexity. In fact, they should do extra planning and develop creative scenarios to understand as many of the possible outcomes as possible. In the end, however, they have to remember Eisenhower's saying, that in preparing for battle, "plans are useless, but planning is indispensable." The planning helps one to envisage how things *might* unfold but cannot explain exactly how things *will* unfold. The value of planning is in the exercise of planning and the creation of alternative scenarios and alternative responses, not necessarily in the result of the planning.

Try, Learn, Adapt

In a complex environment it is truly rare that a grand plan or strategy will work as intended. Successful managers, however, are not discouraged by this. They learn from their missteps and use their learning to move forward with a new angle on the problem. They essentially learn as they go. Furthermore, they expect to learn as they go. Complicated thinkers tend to get too intellectually invested in an idea and refuse to let go, despite sometimes overwhelming evidence that the plan is not working. Complexity thinkers have the humility and flexibility not to get trapped into this low-probability strategy.

With a try, learn, and adapt approach, organizations have to allow for mistakes to be made and for risks to be taken. They do not take large bets on grand projects or get too invested in comprehensive plans. A key characteristic of complexity is adaptation. To succeed with complexity, an organization must also be continually adapting. It is important to note that this does not necessarily mean getting better or continually improving. It is quite possible to keep continually improving on all of the wrong things. Kodak continued to improve its film products, but when digital photos replaced film, all of the continual improvement was for naught. Adapting means developing a keen sense of how elements of the

system are changing and trying new ideas to see how they work in the context of the shifting environment. Ultimately, adapting means changing along with the environment rather than trying to get the environment to change.

For a complicated thinker, adapting to changing and evolving situations can be difficult. It is not easy on the ego to admit that a well-thought-out plan is not going to succeed. However, having the humility and the risk-taking ability to adopt a try, learn, and adapt approach is necessary for success in the presence of complexity. Ecologist and complexity researcher C.S. Holling sums it up best when he states, "in complex systems, wealth should not be measured in

money or power, but in the ability to adapt."

Develop a Complexity Mindset

A complexity mindset is simply a mindset that accepts that complexity exists, accepts that complexity needs to be dealt with differently, and accepts that there are certain limitations on what the manager can control in complex situations. Furthermore, and perhaps most importantly, a complexity mindset embraces complexity and the challenges and opportunities that come with dealing with complexity.

While it is not necessary to be a genius to manage complexity, it is helpful to consider for a minute the difference

between a genius and someone who is really smart. The name "Einstein" often springs to mind when the word "genius" is uttered. While the story that Einstein did not do well in school is a myth, the reality is that Einstein thought differently. The truth is that he was certainly an above-average mathematician but not a mathematical genius. A little-known fact is that most of his mathematical problems were solved by others, including an assistant, Walther Mayer, who solved many of the mathematical equations and did most of the calculations that Einstein's theoretical musings required. Einstein called Mayer "the calculator." Mayer was obviously a very knowledgeable and talented mathematician. Einstein

was a complexity thinker, while Mayer was a very good and very intelligent complicated thinker.

The difference between being super smart and being a genius is relevant for understanding the difference between having a complicated mindset and a complex mindset. Smart people — those who are very efficient in their knowledge of facts and very fast in applying that knowledge — do very well with complicated thinking. Complexity thinkers, however, think differently.

A complexity mindset is a creative mindset. It focuses on what can be, rather than what is. A complexity mindset is an imaginative mindset, as

different from a complicated mindset as the difference between thinking and knowing. Thinking is a creative process, while knowing is an information-retrieval process.

In an ideal world, managers would develop both their technical knowledge and their creativity. In a sense, the manager would become a new kind of Renaissance man. However, instead of possessing knowledge across many different fields, the modern-day "Renaissance manager" would develop both complicated thinking skills and a complexity mindset. There is an approximate parallel between complicated thinking/complexity thinking and being a left-brain thinker

versus a right-brain thinker. Being left-brain dominant is associated with being logical and analytical, while being right-brain dominant is associated with being more intuitive or creative. To excel in complexity requires flexibility in what side of the brain to use. In other words, it requires one to be able to flip between being right-brain dominant and being left-brain dominant. You need to be creative as well as analytical.

The final aspect of developing a complexity mindset is to learn to embrace complexity. Complexity is a fact of business. As long as there are economies, organizations, workers, and managers, there will be complexity in business. The sooner one recognizes and

makes peace with this fact, the better. Complexity is not going to go away. Trying to make complexity disappear or to make it a nonfactor is unproductive and even harmful.

A complexity mindset recognizes that complexity creates both challenges and opportunities. It also creates an avenue for competitive advantage. If for no other reason, this should be more than enough motivation to develop a complexity mindset.

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Using Scenario Planning to Reshape Strategy

Rather than trying to predict the future, organizations need to strengthen their abilities to cope with uncertainty. A new approach to scenario planning can help companies reframe their long-term strategies by developing several plausible scenarios.

Rafael Ramírez, Steve Churchhouse, Alejandra Palermo, and Jonas Hoffmann

June 13, 2017

In recent years, organizations have been caught off guard by economic volatility, unexpected political events, natural disasters, and disruptive innovations. In

response, we are seeing increased interest in scenario planning. Rather than tying their company's future to a strategy geared to a single set of events, many senior executives are coming to the view that smart management benefits from a richer understanding of the present possibilities afforded from multiple views about possible futures.

Scenario planning came to prominence following World War II and gained recognition in the corporate world in the late 1960s and 1970s, around the time when Royal Dutch/Shell used it to help address the turbulence1 caused by the 1973 oil crisis. While several different approaches to scenario planning have emerged since then, this article focuses

specifically on what we call the Oxford scenario planning approach.2 This approach is intended to be collaborative in order to get individuals and groups at all levels and functional backgrounds within an organization to examine an array of factors that contribute to the future and, in the process, to reframe their collective understanding of the present. (See "About the Research.")

About the Research

This paper is part of a long-standing research and practice stream on scenario planning practices and the use of scenarios as a scholarly methodology. The research has included integrating scenario planning with other fields such as social ecology, sense-making, and

design through the Oxford Futures Forum, an interdisciplinary forum. The research has also included an inquiry on specific scenario planning issues raised by participants in executive development programs. Among other things, we have conducted a survey that was completed by 163 professionals who attended our executive education program and that assesses how organizations use scenario planning interventions. We also conducted philosophical and social science investigations into the nature of plausibility, probability, uncertainty, and turbulence. In addition to coauthoring two books, *Strategic Reframing: The Oxford Scenario Planning Approach* (Oxford University Press, 2016) and

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Unlike approaches to scenario planning that take a *probabilistic* stance (that is, making predictions in percentage terms or as best-case/worst-case scenarios3) or a *normative* stance (that is, envisioning what a future should look like), the Oxford scenario planning approach is based on *plausibility*. By recognizing

the part of uncertainty that is unpredictable[4] and by actively exploring the sources of the turbulence and uncertainty, the goal is to iteratively and interactively generate new knowledge and insights to help organizations reperceive their circumstances.[5]

During periods of turbulence, unpredictable uncertainty, novelty, and ambiguity (what the Oxford scenario planning approach refers to as TUNA conditions), organizations frequently experience serious challenges that threaten existing value chains, communities, and even whole fields of endeavor. Such conditions can be unsettling and destabilizing on many different levels. But they also present

opportunities for organizations to reframe their strategies and innovate.6

A core feature in the Oxford approach is making a distinction between the immediate business environment an organization inhabits (where business transactions take place) and the broader environment, or context, in which it operates.7 In principle, our approach focuses on two layers. The first layer is the immediate business environment and includes a company's suppliers, customers, competitors, partners, and other stakeholders. The second layer is made up of all the factors that are beyond the organization's direct influence. Scenario planning is about exploring how the second layer might

transform the first layer. (See "The Role of the Contextual Environment in Scenario Planning.")

The Role of the Contextual Environment in Scenario Planning

In using the Oxford scenario planning approach, it is important to distinguish between immediate actors one does business with (located in the smaller brown oval) and the diverse factors in the larger contextual environment. The contextual factors are beyond the influence of the organization.

Scenario planning is about exploring how larger contextual factors might affect an organization. Scenarios are developed by combining contextual factors (particularly ones that are less well-known and more uncertain). Each scenario will be based on a unique combination of contextual factors.

Contextual Environment

International commerce · International finance · Macroeconomic conditions · Geopolitical trends · Social values · Legislation · Exchange rates · Technology · Energy prices · Ecology · Demographics

Scenarios: the impact of changes in the contextual environment on the transactional environment

Transactional Environment

Competitors · Lobbies · NGOs · Regulators · Suppliers · Investors · Employees · Customers

Organization using scenario planning

Strategy affects how the organization interacts with the transactional environment

In recent years, the Oxford approach has been used to examine a variety of circumstances, including the future of retailing in India, the tourism industry in Mexico, the changing environment in global shipping,[8] and the future role of the European Patent Office.[9] Our experience shows that different organizations have gone about scenario planning in different ways — there is no cookie-cutter method. Nevertheless, we have found that there are a handful of

best practices that the most effective scenario planning processes use. First, they draw on the knowledge and perspective of a broad cross-section of parties, both inside and outside the senior management team. Second, both the participants and the organization are willing to invest time and resources to gain insights.

And third, successful scenario planning processes are committed to examining and understanding *plausible* futures as opposed to *probable* futures. In turbulent and uncertain conditions, it is impossible to assign precise probabilities to possible scenarios.10 As a result, the Oxford scenario planning approach eschews assigning

probabilities to scenarios and instead focuses on identifying and developing scenarios that the group finds plausible, challenging, and useful. Each scenario consists of a story that relates to possible changes in the larger contextual system in which an organization operates.11

In this article, we examine two cases in which the Oxford approach to scenario planning was used. The first case involves Rolls-Royce plc, a leading supplier of power systems for aircraft and the marine and energy markets; the second case looks at the Royal Society of Chemistry, a London, U.K.-based international organization involved in advancing the field of chemical

sciences. In addition to showing how these organizations used scenario planning, we will discuss the challenges and opportunities of scenario planning more broadly. (See "Putting Scenario Planning to Work.")

Putting Scenario Planning to Work

Here are five important characteristics of the Oxford approach to scenario planning:

1. Scenario planning involves attending explicitly to what is framed in and what is framed out when setting strategy. In the scenario planning process, what matters is not so much the organization's strategy itself but *the frame* that strategy is built on.

The frame is made up of assumptions, and these assumptions implicitly shape how the strategy comes together. For example, a frame might include the period of time you are considering; the breadth of factors to be included; whether the scenario planning process is to be predominantly competitive and collaborative; whether it is a one-time activity as part of the yearly planning cycle; or whether the strategy should be shared or kept secret.

2. By proposing a limited number of scenarios, scenario planning enables organizations to reperceive current and plausible future contexts. For example, at the Royal Society of Chemistry, the links between disciplines

and between scientists and artificial intelligence are different in each of the scenarios.

3. Scenario planning relies on iterative reframing and reperception. By building several frames from the contextual environment factors, strategists have an opportunity to see the actors they do business with take different roles in each scenario. For example, a supplier in one scenario could be a partner in another scenario. This allows strategists to revisit the role configuration used in the current strategy — reexamining the assumptions and bringing in new questions to consider.

4. Everyone involved in and affected

by the process should be considered a learner. This means that people involved with scenario planning need to work on the organization rather *in* it. Having external facilitators or dedicated staff members assigned to the process helps make this possible.

5. Scenario planning is designed to explore different types of weak signals.i Either they are weak because they are very new (scenario planning considers how they might look when they have been around longer and are stronger); they are weak in relation to other signals managers might respond to (scenario planning focuses on how they might become salient); or they are weak in relation to the dominant cultural,

strategic, or professional frame (scenario planning invites its intended users to look at them from an alternative framework). In order to explore weak signals, scenario planning needs to focus on the plausible as opposed to the probable.

Scenario Planning at Rolls-Royce

Rolls-Royce was founded in 1906 to produce quality cars in the United Kingdom. Although Rolls-Royce Holdings plc is no longer in the auto business (that operation is owned by BMW AG), it is currently involved in the design, manufacturing, and distribution of power systems for aviation and other industries. With

underlying revenue of £13.8 billion and about 50,000 employees,[12] the company has 50% of the wide-body airliner propulsion market. Rather than selling the equipment outright, it generates much of its revenue by selling power services by the hour to aircraft operators.[13]

Rolls-Royce avoided the worst consequences of the 2008 financial crash, thanks to its substantial order book and the stability of its aftermarket service business, but in early 2014 the company ran into difficulties. These involved a cyclical decline in wide-body airliner orders, the slowdown in the growth rate of the Chinese economy, and the end of a commodities boom,

which impacted the corporate jet business. Also, oil price declines affected both the marine and energy markets, and the company's civil nuclear power business suffered in the wake of the accident at a nuclear power plant in Fukushima, Japan, in 2011. While these events were mostly unrelated, they affected every aspect of Rolls-Royce's business. During 2014 and 2015, management issued five profit warnings, and the share price fell more than 50%. An activist investor bought just over 10% of the stock, and there were calls from some commentators to break up the company.

The arrival of a new CEO in July 2015 greatly intensified the company's search

for ways to improve its prospects. That summer, several dozen of the company's top managers participated in an executive education course at Oxford University. One of the early sessions focused on scenario planning. Based on what the executives heard, some of them began to lobby internally within Rolls-Royce for a company-wide scenario planning process. The idea was to catalog significant factors that might affect Rolls-Royce by the year 2040[14] and to develop a set of strategic questions. Management agreed to pursue this course, and over the next few months, management, in conversation with board members, began working with some of the authors of this article to design and run a

program for developing and reviewing a set of future scenarios.

Process

To kick off the process at Rolls-Royce, about 25 mid- and senior-level Rolls-Royce executives were selected from different business units, functions, and locations. In preparation for a three-day workshop slated for early 2016, this group was asked to begin studying a wide range of topics deemed to have relevance to the company's future. Among the topics: the future of Moore's law; tools for detecting counterfeit parts (and the distinctions between fake and real); and how transportation needs are likely to change in response to factors such as environmental concerns and

migration patterns.

On the first day of the workshop, the participants were asked to present posters summarizing their research. Then the group was divided into four subgroups and given the task of creating scenarios for Rolls-Royce for 2040. According to the assignment, the scenarios had to be plausible and relevant to Rolls-Royce's circumstances, and also had to challenge some of the assumptions underlying the company's current strategies.

On the second day, the subgroups shared their draft scenarios with the larger group. Based on the feedback, participants began to coalesce behind three draft scenarios. The first scenario

envisioned a world of high connectivity, where efficiency and collaboration would be the norm. The second one saw the emergence of a new world order, where India and China leverage technology to rival the United States, and other countries are forced to adjust accordingly. And the third scenario anticipated a highly divided (and unequal) digital future that some groups would be able to take full advantage of and others would not.

On the third day of the workshop, participants held a final meeting to review and critique the scenarios, and to consider four strategic questions.

- **What would digitization look like in the future?** For example, in what ways would digital technology radically reshape society and the way business is conducted?

- **What factors would affect relations between employees and companies in 2040?** For example, how might changing employee expectations about long-term employment affect how organizations are structured?

- **What conditions will determine the future of emerging markets?** For example, to what extent would political factors and factors such as controls on immigration weaken the trend toward globalization?

- **How might technology pathways develop?** For example, how will future technologies change the power systems market?

Outcomes

Following the three-day workshop, Rolls-Royce management endorsed the scenarios as a new basis for the 2016 strategic planning process and began sharing them with the wider strategy community and the company's senior executives. In practice, this meant that any investment proposal had to take into account how it would be affected by each of the three scenarios and what, if anything, should be done to mitigate or exploit the scenarios; investments that

didn't meet this qualification were rejected. The scenarios therefore became a determining factor in the selection of the investment initiatives that emerged from the 2016 strategy process. Already, outlines of the scenario futures have begun to become apparent. There is little doubt, for example, that the unfolding digital future provides advantages to some groups and disadvantages to others. According to Rolls-Royce, the scenarios provided the backdrop for the company's 2017 strategy development process.

Scenario Planning at the Royal Society of Chemistry

In contrast to Rolls-Royce, where the

objective of the scenario planning process was to envision future directions for one organization, the goal at the Royal Society of Chemistry (RSC) was broader: to understand how the chemical sciences might evolve over the next 10 to 20 years, and how the changes might impact industry, academia, and society at large.

Scientific, social, and technological trends are rapidly changing the way people live and work, and these changes have affected the nature and practice of chemistry as well as the roles of chemists. While chemistry is a mature discipline and forms the basis of our fundamental understanding of what happens at the atomic and molecular

levels, it is also concerned with the creation of new matter and interacts with disciplines such as biology and astronomy. What's more, it plays a key role in solving practical problems such as curing disease; developing sustainable energy, food, and water; and creating new industries.15 As chemistry faces new opportunities and obligations, the fundamental question was: How should people think about the future of chemistry?16

The mission of the RSC is to advance excellence in the chemical sciences for the benefit of science and humanity. Its roots go back to the 1840s, when a group of 77 scientists, who included doctors, academics, manufacturers, and

entrepreneurs, founded the Chemical Society of London. Today, the RSC has more than 55,000 members worldwide and a reputation as an influential champion for the chemical sciences.

In December 2014, the RSC launched a long-range planning initiative with a broad set of goals. Although the initiative did not refer to scenario planning per se, its aim was to identify possible future directions for the chemical sciences and to anticipate, plan, and prepare for how the field might unfold over the next 10 to 15 years.

The RSC began by identifying some of the big questions its leadership wanted to consider: How might the identity of

chemistry change? Could chemistry be facing a future in which academic chemistry departments disappear altogether? If public funding is not available to support the type of blue-skies research that has traditionally produced the next major advances, how will future research be funded? And how will increasingly sophisticated technology and computational techniques change the way new hypotheses are analyzed and tested?17

Process

The RSC convened a one-day workshop for the leadership team and selected senior managers to consider a wide range of factors. The workshop helped focus senior staff members from

throughout the organization on the importance of taking a broad look at how the field was changing, and it set the stage for defining the new role the RSC could play.

What followed was the development of a multiphase scenario planning program. In phase one, which ran for three months, approximately 50 stakeholders from industry, government, and academia who had been selected by the RSC leadership team, were interviewed by phone to identify possible trends.

Next, there were a series of follow-up in-person interviews with some of the stakeholders in order to understand controversial viewpoints or, in some cases, to secure buy-in from key

chemical industry leaders. During this process, several themes emerged. Some of the themes had a direct bearing on the chemical sciences (for example, new opportunities for funding research). Others raised questions about how technology might influence the chemical industry, and the effect of changes on intellectual property, the market, and social factors.

Based on the themes, the RSC ran three one-day scenario-planning workshops (two in London and one in Boston) as a vehicle for identifying weak signals that might emerge as important catalysts of future change. The goal was to spark conversations about the future in order to help executives, academics, and

policy-makers make more proactive decisions. Each workshop was attended by about 10 people.

In an effort to challenge the assumptions of leaders in the chemical sciences, the RSC developed four scenarios.

- The first scenario focused on the benefits chemistry brings to the world — its ability to provide answers to global challenges, such as climate change, water shortages, natural resources scarcity, and providing health care for an aging population.
- The second scenario focused on changes in the way chemistry is done and how it is organized, envisioning a world where the chemical sciences are increasingly automated and decentralized.
- The third scenario spoke to the growing separation of chemistry into subdisciplines and how that might negatively impact the pipeline of future chemists.
- And the fourth scenario explored the impact of reduced public funding for the chemical sciences.

Outcomes

These scenarios helped to develop the RSC's long-term strategy and to nudge leaders in the chemical sciences to move

beyond conventional thinking and plan for the future. The RSC's original long-range planning team continues to play a role in encouraging the chemical community to reflect on opportunities and challenges. The findings from the scenario planning process were issued in a 2016 report18 aimed at broadening engagement with RSC communities. The organization's leadership team has said it wants to initiate new activities based on the scenarios, including launching new programs to advance the future of chemistry education and scholarly communication consistent with developments in open-access publishing and the trends in open science; bringing the RSC "futures thinking" conversation to a wider

audience (including the organization's general assembly and meetings with international partners around the world); and preparing for the different possible futures through internal strategic conversations with senior management and the RSC's external governing body.

Each element of the RSC's new strategy, which the governing board is slated to approve in July 2017, has been tested against the opportunities and challenges identified by the scenario planning work. The next priority will be to amplify the voice of the chemistry community. This will involve the RSC management sharing success stories from the chemical sciences community not only with other companies but also

with governments, funders of research, and society at large. In addition, the RSC has set a goal of improving how it listens to the broader community.

Reframing Strategy

As the Rolls-Royce and RSC cases show, scenario planning can help strategists look beyond their current circumstances — and with longer time horizons — to test existing strategies, make sense of the causes and effects of turbulent, uncertain, or ambiguous conditions; invent new options; open up or enhance the quality of strategic conversations; and pave the way for collaborative strategies.

So, what does this mean for strategists

or policy-makers at companies and nonprofit organizations that want to consider future directions? Based on our experience, we have four recommendations.

1. Invest time and effort in preparing participants. First, it's important to identify who the intended participants in the scenario planning process should be and how these participants learn. Typically, because the board's role is to question and prod the executive team, scenario planning is easier to align with the board than with the executive team. But in cases where strategies have run into trouble or there is a new management team, senior leaders may welcome the opportunity to engage in

scenario planning. We have found scenario planning generates the most value when it's clear who the intended learners are and what they wish to learn. Indeed, as a rule of thumb, organizations should expect to spend twice as much time setting expectations and defining the intent and usability of their scenarios as they do producing the scenarios themselves. It pays to invest time and effort throughout the process — both in preparing the participants and setting expectations at the outset, as well as in using the scenarios in strategy development. Otherwise, the scenario planning exercise may become a waste of time.

2. Help participants identify the

assumptions about the future that underpin their current strategy. You should be prepared to help the learners articulate their sense of the future and the set of assumptions they are using in their current strategy. In our experience, this part of the process depends heavily on gathering information and developing insights gained from internal and external interviews. Scenario planning that explores a limited number of scenarios (usually between two and four) helps to develop an alternative to the existing framing.

3. Be prepared to invest significant amounts of time and resources in the scenario planning process. Although every situation is different, the amount

of time and resources required will depend on what the organization is trying to achieve and its goal. Scenarios that will be presented broadly or publicly tend to require much more detail and peer review (and, as a result, more time and budget) than less formal scenarios involving small teams who are used to working together.

4. Remember that scenario planning is an iterative process. In our experience, this point cannot be overemphasized. It's important to recognize that the initial set of scenarios that organizations develop may not be sufficient. Often, additional insights are gathered in a second iteration. Rolls-Royce, for example, began with a total

of 12 scenarios before multiple iterations led it to focus on three.

Organizations need to have criteria for assessing whether the scenarios they develop are plausible. (By plausible, we mean that they should be neither too improbable nor too familiar.) At the same time, executives and board members need to ask themselves whether the scenarios are sufficiently challenging, easy to communicate, and capable of being adopted.

As we have worked with organizations, we have noticed that considerable value can be extracted from reconsidering and reperceiving the immediate business environment that each of the different scenarios implies. In reconsidering how

the roles of one actor change from one scenario to another, managers can gain new perspectives and see how new actors begin to emerge. The scenario planning approach we have described helps organizations assess the kinds of threats and opportunities that might occur in turbulent, unpredictable, and ambiguous settings. By freeing the mind from the current framing, strategists can use the process to envision and begin to implement a new set of options.

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The Flare and Focus of Successful Futurists

The ability to plausibly forecast the future requires alternating between broad and narrow ways of thinking.

Amy Webb

March 17, 2017

Futurists are skilled at listening to and interpreting signals, which are harbingers of what's to come. They look for early patterns — pretrends, if you will — as the scattered points on the fringe converge and begin moving toward the mainstream. The fringe is that place where hackers are experimenting, academics are testing

their ideas, technologists are building new prototypes, and so on. Futurists know most patterns will come to nothing, so they watch and wait and test the patterns to find those few that will evolve into genuine trends. Each trend is a looking glass into the future, a way to see over time's horizon. This is the art of forecasting the future: simultaneously recognizing patterns in the present and thinking about how those changes will impact the future so that you can be actively engaged in building what happens next — or at least be less surprised by what others develop. Futures forecasting is a learnable skill, and a process any organization can master.

Joseph Voros, a theoretical physicist and senior lecturer in strategic foresight at Swinburne University of Technology in Melbourne, Australia, offers my favorite explanation of futures forecasting, saying it informs strategy making by enhancing the "context within which strategy is developed, planned, and executed."1 The advantage of forecasting the future in this way is obvious: Organizations that can see trends early can better prepare to take advantage of them. They can also help shape the broader context, with an understanding of how developments in seemingly unconnected industries will affect them. Most organizations that track emerging trends are adept at conversing and collaborating with those

in other fields to plan ahead.

Although futures studies is an established academic discipline, few companies employ futurists. That's starting to change as more leaders become familiar with the work futurists do. Accenture, Ford, Google, IBM, Intel, Samsung, and UNESCO all have had futurists on staff, and their work is quite different from what happens within the traditional research and development (R&D) function.

The futurists at these organizations know that their tools are best used within a group — and that the group's composition matters tremendously to the outcomes they produce. Here's why. Within every organization are people

whose dominant characteristic is either creativity or logic. If you've been on a team that included both groups and didn't have a great facilitator during your meetings, your team probably clashed. If it was an important project and there were strong personalities representing each side, the creative people felt as though their contributions were being discounted, while the logical thinkers — whose natural talents lie in managing processes, projecting budgets, or mitigating risk — felt undervalued because they weren't coming up with bold new ideas. Your team undoubtedly had a difficult time staying on track, or worse, you might have spent hours meeting about how to have your next meeting. I call this the "duality

dilemma."

The duality dilemma is responsible for a lack of forward thinking at many organizations. It contributed to the decline of BlackBerry Ltd.'s smartphone business; the company (formerly known as Research in Motion Ltd.) never had an executable plan to remake the phone's form factor and operating system in the age of the iPhone. Right-brained creatives wanted to make serious changes to the phone, while left-brained process thinkers were fixated on risk and maintaining BlackBerry's customer base.[2] The future of the business hinged on the company's ability to bring both forces together to forecast trends and plan for the future.

BlackBerry's experience suggests that forecasting the future of a product, company, or industry should neither be relegated to inventive visionaries nor mapped entirely by left-brain thinkers. Futures forecasting is meant to unite opposing forces, harnessing both wild imagination and pragmatism.

Turning a Dilemma Into a Dynamic

Overcoming the duality dilemma — and getting full use of both your creative- and logic-oriented team members — in order to track emerging trends and forecast the future is possible. But counterintuitively, it's a matter of highlighting — rather than discouraging or downplaying — the strengths of each

side. Stanford University's Hasso Plattner Institute of Design (also known as the d.school) teaches a brainstorming technique that addresses the duality dilemma and illuminates how an organization can harness both strengths in equal measure by alternately broadening ("flaring") and narrowing ("focusing") its thinking.3
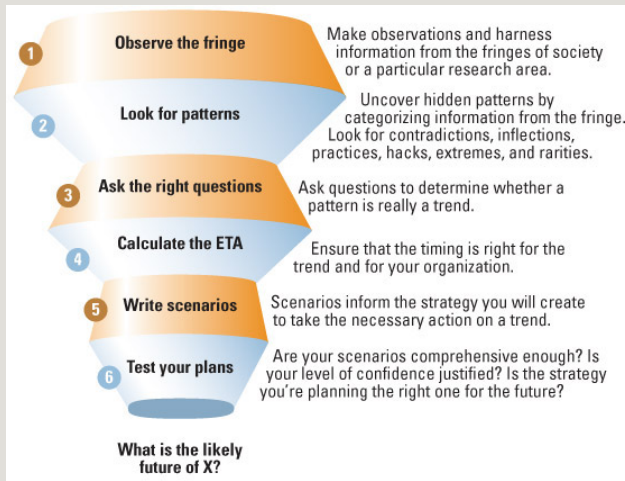
When a team is flaring, it is finding inspiration, making lists of ideas, mapping out new possibilities, getting feedback, and thinking big. When it is focusing, those ideas must be investigated, vetted, and decided upon. Flaring asks questions such as: What if? Who could it be? Why might this matter? What might be the implications

of our actions? Focusing asks: Which option is best? What is our next action? How do we move forward?

The forecasting method I have developed — one, of course, influenced by other futurists but different in analysis and scope — is a six-step process that I have refined during the past decade as part of my work at the Future Today Institute. The first four steps involve finding a trend, while the last two steps inform what action you should then take. (See "A Six-Step Forecasting Methodology.")

A Six-Step Forecasting Methodology

The six steps in this forecasting methodology require teams to alternate between broadening (that is, "flaring") and narrowing (that is, "focusing") their thinking.

Step		Description
1	Observe the fringe	Make observations and harness information from the fringes of society or a particular research area.
2	Look for patterns	Uncover hidden patterns by categorizing information from the fringe. Look for contradictions, inflections, practices, hacks, extremes, and rarities.
3	Ask the right questions	Ask questions to determine whether a pattern is really a trend.
4	Calculate the ETA	Ensure that the timing is right for the trend and for your organization.
5	Write scenarios	Scenarios inform the strategy you will create to take the necessary action on a trend.
6	Test your plans	Are your scenarios comprehensive enough? Is your level of confidence justified? Is the strategy you're planning the right one for the future?

What is the likely future of X?

The dynamic of flare and focus is woven through this forecasting methodology. The six steps require teams to alternate between flaring and focusing, harnessing the dominant qualities of the right brain and the left brain. With each step, you are able to understand the likely future of the topic you're examining more clearly as you define a trend, determine the best action to take, and create and test your strategy. When

you both flare and focus, you are able to overcome the duality dilemma.

Here's how to use these complementary ways of thinking:

1. First, flare at the fringe. Keep an open mind as you cast a wide enough net and gather information without judgment. This involves creating a map of what you observe at the fringe. This map should show nodes — or key concepts, companies, places, and people — and the relationships between them. Think of it as rounding up the "unusual suspects." You're brainstorming, making a fringe map, forcing yourself to think outside the box and consider radically different points of view.

2. Focus to spot patterns. You must narrow your research from the fringe and uncover the patterns hidden in your sketch to spot possible trends. To categorize what we have observed, we use a framework called CIPHER, which is an acronym that stands for *contradictions*, *inflections*, *practices*, *hacks*, *extremes*, and *rarities*. Look for surprising contradictions; inflection points that signal an acceleration of some change in progress; new practices that upset established norms (for example, when people altered the long-established norm of watching television programming only on TVs); hacks and adjustments that users are making to a product or technology to make it work better for them; extremes that push

boundaries to break new ground; and rarities.4

3. Flare to ask the right questions. Determine whether a pattern really is a trend or merely a trendy flash in the pan. You will be tempted to stop looking once you've spotted a pattern; most forecasters never force themselves to poke holes into every single assumption and assertion they make. But you will soon learn that creating counterarguments is an essential part of the forecasting process.

4. Focus to calculate timing. Interpret the trend, and ensure that the timing is right. This isn't just about finding the typical S-curve that managers rely on to describe adoptions of a new innovation

or technology; such an S-curve can show a new technology's adoption, but it does not offer a full picture of how external effects (such as a change in government leadership or a natural disaster) could affect its development. As technology trends move along their trajectories, two forces are in play — internal developments within tech companies, and external developments within the government, adjacent businesses, and the like — and both must be considered.

5. Flare to create scenarios and strategies. First, build scenarios to create probable, plausible, and possible futures; then create strategies to accompany them. Probable scenarios

represent the most likely outcomes if there are no unexpected major changes in circumstances, while plausible scenarios allow for many facets of daily life — some that we might not be able to imagine now — to change dramatically. Meanwhile, possible scenarios assume that nothing is set in stone — and that life as we know it could look radically different than it does today.

This step requires thinking about both the timeline of a technology's development and your emotional reactions to all the possible outcomes. What necessary strategies and ways of thinking will govern how your organization will respond to the trend?

Score each scenario with an estimated likelihood of occurrence and, on the basis of your analysis, create a corresponding strategy for action. A score of less than 40% suggests either you haven't analyzed enough data or it is too early in the timeline to act; a score of more than 70% indicates that you've likely waited too long and should respond quickly.

6. Focus to test your plans. But what if the action you choose to take in response to a trend is the wrong one? In this final step, you must try to test whether the strategy you create to address a trend will deliver the desired outcome, and that requires asking difficult questions about both the present

and the future. These questions should confirm that (1) your organization has confidence in the strategy and will support it; (2) the strategy offers your customers a unique value proposition; (3) you can track the developing trend and measure your outcomes; (4) the strategy communicates a sense of urgency to your staff and to your intended audience; (5) you have the resources needed to recalibrate the strategy if and when needed; and (6) the strategy is robust enough to easily accommodate change.

Duality in Action

Any organization intent on surviving and thriving into the future must practice both flaring and focusing in

whatever methodology it uses to spot trends, so it is of paramount importance that every team charged with watching and acting on trends include both creative and logical types. Organizations that learn how to balance each hemisphere of the human brain are uniquely positioned to forecast trends and develop strategies that work.

And as you analyze emerging trends, remember: There are never any completely new technologies invented out of whole cloth. Our technology trends, their adoption for use in business, and the cultural, political, educational, and economic shifts that happen concurrently are all interwoven. Our tapestry of invention is part of a

continuum over time. The tools may change — from hands, to weavers, to industrial machines, to algorithms and robots, to self-generating synthetic organics — but the previous corpus of research always becomes the basis for fresh thinking at the fringe.

The future is something we are creating now, in the present tense. You have the ability not only to forecast what's to come but also to help create your own preferred future. Don't wait.

Amy Webb is the CEO of the Future Today Institute, which provides futures forecasting for business, government, and nonprofit clients, and the author of *The Signals Are Talking: Why Today's*

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